

# ARUN JOLLY

PHD STUDENT | PROGRAM 2  
ARC TRAINING CENTRE FOR JOINT BIOMECHANICS

PhD duration: May 2021 to November 2024

**My interests:** Career in research and development of medical technologies , Robotic testing, Finite element modelling , CAD modelling, Medical imaging, Product design and development.

The orthopedic sector faces problems in delivering patient outcomes including significant revision rates and lack of computer assisted technologies to improve surgery outcomes and provide personalized patient care. In the shoulder joint focused sector, there is potential in the fields of joint stability, reconstruction techniques, implant testing and implant stability.



**BTech** (Mahatma Gandhi Uni)  
**MEng** (Deakin Uni)

**Supervisors:**  
A/Prof. Saulo Martelli, Prof Peter Pivonka  
& Dr Dermot O'Rourke

## PROJECT OVERVIEW

**Project Title:** In vitro investigation of the passive stability of the glenohumeral joint

### THE PROBLEM

- There is a lack of an in vitro standard experimental protocol to quantify the passive stability of the glenohumeral joint.
- Unsystematic approaches are taken to report valuable information regarding the passive stability of the glenohumeral joint and as such there is limited knowledge on the relationship between the anatomy and the passive stability of the glenohumeral joint across a population.

### **Why do we need more research into in vitro models of the shoulder?**

Historically, in vitro studies on the passive stability of the glenohumeral joint have reported considerable results and these results have been used in developing pre-operative planning, operative procedures and post-operative rehabilitation. For instance, one such group of studies tries to determine the role of soft tissues in providing stability to the glenohumeral joint. There is an inevitable need for more systematic approaches towards the studies focusing on the passive stability of the glenohumeral joint since these studies directly correlate to the work done by clinicians in treating patients.

### **How can my research address this problem?**

The aim of this research is to develop an experimental protocol that can quantify the passive stability of the glenohumeral joint addressing the unsystematic approaches and inconsistencies found in the literature. Moreover, the research will investigate the relationship between the anatomy and passive stability of the glenohumeral joint across a population which will, in turn, be an input towards the research focused on personalised patient care.

### HYPOTHESIS

The development of an in vitro standard protocol for quantifying the passive stability of a glenohumeral joint will address the limited knowledge and inconsistencies centred around the passive stability of the joint.

### PROJECT AIMS

1. To develop an in vitro experimental protocol to quantify the force response of a glenohumeral joint to 6DOF robot loading.
2. To investigate the response of the glenohumeral joint to 6DOF loading with sequential resection of stabilizing structures.
3. To investigate the relationship between the anatomy and the passive stability of the glenohumeral joint across a population.

### OUR SOLUTION & EXPECTED OUTCOMES:

The proposed research methodology aims at extracting valuable information on the shoulder joint stability by employing a systematic and well-informed testing protocol. This in turn is achieved through the combination of technologies including robotic testing, medical imaging, optical motion capture and statistical analysis. The methodology can be further transferred into research on other human joints, implant stability and passive joint motion. Moreover, the outcomes from this research can be used to inform the orthopedic community on performing preoperative planning and operative procedures including joint replacements and reconstruction surgeries. Furthermore, the inputs to the post operative rehabilitation protocols provided from the outcomes of this research can be utilized by shoulder surgeons to deliver better patient care.

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